

Customer-centered and Technology-Enabled Homecare Service: Opportunities for Value Creation

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ABSTRACT

In the advancement of society, the ability to provide quality healthcare has been increased, and the use of smart technology in the healthcare environment has been widely seen. The study uses in-depth interviews and field observation methods to collect data, aiming at understanding the perspectives and needs towards technology-enabled services. In addition, according to the results of the interviews, the user journey maps for each of the three technological solutions (smart pillbox, smart mattress, wearable device) we proposed have been drawn, and the pain points, touchpoints as well as opportunities of each role have been discussed and summarized. Lastly, the blueprint of the entire home care service has been depicted, which we expected to provide a reference for home care service providers for applying smart technologies to their homecare service models and create new value from managing their operations.

Keywords: Home care, user journey map, service blueprint, pain point, service process improvement.

INTRODUCTION

With the progress of society and the rapid development of medical technology, the proportion of the world's elderly population has risen dramatically. The aging society has become an important global issue. It not only changes the population structure but also affects the overall quality of medical services. In Taiwan, according to the estimation of the National Development Council, Taiwan will become a super-aged society by 2026, where at least 20 percent of the population is 65 or older (National Development Council [NDC], 2018). This might lead to an increase in health costs and social problems for personal care since elderly people are often faced with some chronic diseases such as diabetes, high blood pressure, or dementia. A report made by the Ministry of Health and Welfare (Taiwan) indicates that the number of people who need long-term care will increase from 557,000 in 2017 to more than 770,000 in 2026, and the proportion of the elderly has been increasing year by year (Ministry of Health and Welfare [MHW], 2016). Besides, due to Taiwan's declining birthrate, the old-age dependency ratio will increase to about 30 percent by 2026. Nursing manpower and medical care resources might not be able to meet the huge demand in the future. Therefore, it is urgent to reform the long-term care system in Taiwan.

Previous studies have shown that many elderly people are unwilling to live in care institutions but prefer to live in a familiar environment with personal privacy and a sense of belonging (Wang *et al.*, 2019). This shows no difference in Taiwan. From a survey of the living conditions of the elderly over the years, more than 60 percent of the elderly expressed that they do not want to live in a care institution. It can be seen that aging in place is not only an international trend but also more conform to the expectations and wishes of most elderly people. However, they sometimes cannot get immediate care when facing illness, and when an emergency occurs, they often delay seeking help or cannot obtain effective treatment. For these reasons, how to implement a high-quality and efficient long-term home care system to cope with the rapidly aging society has become a top priority for Taiwan.

Technology is a key instrument for a new concept of home care. With the development of various smart technologies, like IoT devices, sensors, artificial intelligence, how to apply them to the health care environment has been widely regarded. Countries across the world are also actively introducing smart technologies into the field of long-term care, hoping to make the elderly enjoy their old age more humanely and healthily (Haslwanter *et al.*, 2018). Existing research on technology-enabled home care services mainly focused on the detection of physiological status and the study of home-based medical devices. Apart from the discomfort manifested by physiological signals, there are other problems plaguing the elderly such as the caregiver's service level and care-receiver's psychological level, and so on.

Therefore, through semi-structured interviews, field observation, and the use of user journey mapping, this study aims at exploring the potential needs and pain points in long-term home care services, finding out what technology can be applied, and

understanding the elderly's attitudes towards technology-enabled services. A technical solution is then presented and drawn into a service blueprint according to these pain-point needs. We expected to provide a reference for home care service providers for applying smart technologies to their homecare service models and create new value from managing their operations.

LITERATURE REVIEW

Long-Term Home Care Services for The Elderly in Taiwan

According to Kane & Kane (1987), long-term care (LTC) was defined as providing health, personal care, and social services over a sustained period of time to people with congenital or acquired disabilities. Based on the concepts of long-term care, "home care" is one of the approaches to support "aging in place" since many older adults wish to live in their own familiar environment as long as possible. The benefits of home care are that the care is given in the comfort of the elderly's home, and it allows more freedom and independence. Furthermore, home care could reduce pressure on family members, who have always been the main provider of long-term care in Taiwan. (Liu et al. 2014; World Health Organization [WHO], 2015).

In Taiwan, long-term home care services can be mainly divided into two categories, which are "home care service" and "home health care services" (Chiu, 2016). Home care service offers non-clinical help, such as providing companionship and assistance with activities of daily living (ADL). For example, services such as bathing and toileting, taking medicine, meal preparation, getting in and off the bed, back-patting, dressing, and so on. Compared with home care, home health care service focuses more on providing professional medical assistance. Home health care service is usually ordered for elderly adults who require assistance with recent injuries, who are sick in bed, or who have been diagnosed with a chronic condition, like diabetes or other diseases. Medical services include the following: Wound care, rehabilitation, monitoring of health status, health education, etc. (MHW, 2016).

In order to use the home care service, people first have to apply to the care management center of each county or city in Taiwan. Based on the physiological, psychological, economic, and social support status of the elderly, and the individually caring program will be planned and tailored to their needs. When the application is approved, well-trained caregivers recruited by social welfare organizations will then be assigned to provide various services to the elderly with disabilities or chronic illness in their home regularly (Liao *et al.*, 2009).

Aging Society and the Role of Smart Technologies in Home Care Service

With the burgeoning elderly demographic in Taiwan, the need for life support and health care is growing rapidly. However, under the trend of declining birth rate, the number of middle-aged people caring for elderly patients is increasing, which causes a heavy burden. Consequently, it is no longer possible to simply think about increasing caring manpower or medical resources to satisfy the needs. In order to decrease the burden of manpower and increase the care service quality, smart technologies have been increasingly developed and used in healthcare in recent years (Huang *et al.*, 2019).

Smart technologies were used for gathering and monitoring patient data, remote diagnosis, and treatment, providing a more convenient and efficient tool for caregivers. For example, elderly people with mobility difficulties often lie in bed, which becomes the most accident-prone area in a home care environment. Smart mattress can monitor the elderly's in-bed posture by using pressure sensors, and if the elderly tries to leave the bed themselves or are in the same posture too long, the smart mattress will remind the caregivers immediately in order to prevent falling accident or bedsore (Hong, 2018; Li & Xu, 2020). Besides, elderly people often suffer from poor compliance with medication, such as taking the wrong medicine, forgetting to take medicine due to illiteracy, or hypomnesia (Roy *et al.*, 2017). These situations will affect the therapeutic effect or even cause physical discomfort. The smart pillbox was designed to assist elderly people, reminding them to take the right dose of medicine at the right time and track their medication (Solanki & Zope, 2018). A wearable device is also a well-discussed technology in the health care field, and it can collect care receiver's physiological indicators, such as heartbeat, blood oxygen, blood pressure, temperature, blood sugar, or stress status, and can also be used to track the location of the elderly or emergency call (Wang *et al.*, 2017). Overall, these technologies are aimed at reducing the burden on caregivers, improving the quality of life of the elderly, and maximizing the effectiveness of the input of care resources.

Using smart technologies to cope with the health problems of an aging society might seem straightforward (Malwade *et al.*, 2018). Much research on smart technologies used in healthcare has mainly focused on technology adoption (Pal *et al.*, 2018) or the development of the function of the technology devices. However, the implementation of the technology becomes complicated due to user experience. Still, there is a lack of evidence concerning users' practical experience based on the journey mapping method. To know whether these technologies meet the needs of the elderly using home care services in Taiwan, it must be understood through the user's actual experience and opinion. Consequently, this study utilized user journey maps to investigate the elderly's user behavior and their acceptance of the technologies.

RESEARCH METHODOLOGY

Research Methods

The whole research can be divided into two stages. Firstly, we try to explore the potential needs and pain points in current long-term home care services and find out what technology can be applied. Based on the literature review and analysis, we first understand the development and current situation of home care in Taiwan. Then, through semi-structured interviews and field observation, the elderly's needs and pain points are described and analyzed. We then put forward some suggestions on introducing smart technologies in-home care services. Secondly, in order to understand the elderly and caregivers' attitudes toward the technology-enabled services, we conducted an interview based on grounded theory (Glaser & Strauss, 1967) to find out the direction of improving and strengthening the proposed technological home care service. Then, the pain points, contact points, opportunities, and solutions are analyzed with the user journey map and service blueprint to optimize the technological home care process.

Research Subjects

In the first stage of the research, we select four frail elders who are cared for at home. They are the groups who have not reached the level of long-term care but need to be cared for due to factors such as aging or frailty. Therefore, we are better able to obtain detailed information from them through interviews.

In the second stage of the research, in order to understand the elderly and caregiver's attitudes toward technology-enabled services, We conducted in-depth interviews with 4 care receivers (code P) and their 4 caregivers (code C). All the care receivers who participated in the interview were over 65 years old who needed care. One interviewee had a face-to-face interview at home, and the other three had the interview online because of the severe epidemic. Besides, the caregivers involved in the interview are of a wider range of ages, ranging from young adults to old people (30 to 70 years old). One interviewee had a face-to-face interview in his office, while the other three were interviewed online. Detailed information of the interviewees is shown in Table 1.

Table 1: Interviewees' information of the second state of the research

Interviewee ID	Gender	Age	Symptoms	Pain Points	Technology Application
P1	Male	82	<ul style="list-style-type: none"> ⑩ Cancer ⑩ Foot surgery ⑩ Mobility impaired 	<ul style="list-style-type: none"> ⑩ Light sleep ⑩ Inconvenient getting in and out of bed 	<ul style="list-style-type: none"> ⑩ Smart pill box ⑩ Smart mattress ⑩ IoT device
P2	Male	71	<ul style="list-style-type: none"> ⑩ Stroke ⑩ High blood pressure 	<ul style="list-style-type: none"> ⑩ Mobility impaired ⑩ Forgot to take medicine 	<ul style="list-style-type: none"> ⑩ Smart pill box ⑩ Smart mattress
P3	Female	68	<ul style="list-style-type: none"> ⑩ Cancer ⑩ Abdominal surgery 	<ul style="list-style-type: none"> ⑩ Forget to take medicine ⑩ Depraved appetite 	<ul style="list-style-type: none"> ⑩ Smart pill box
P4	Male	88	<ul style="list-style-type: none"> ⑩ Macular Degeneration ⑩ Hard of hearing ⑩ Alzheimer's disease (mild case) 	<ul style="list-style-type: none"> ⑩ Get lost easily ⑩ Can barely see things, need others guidance ⑩ Forgot to take medicine 	<ul style="list-style-type: none"> ⑩ Smart pill box ⑩ IoT device
C1	Male	46	-	<ul style="list-style-type: none"> ⑩ Patient with low mobility ⑩ Patient often forgot to take medicine 	<ul style="list-style-type: none"> ⑩ Smart pill box ⑩ Smart mattress
C2	Male	39	-	<ul style="list-style-type: none"> ⑩ Patient often forget to take medicine 	<ul style="list-style-type: none"> ⑩ Smart pill box
C3	Male	44	-	<ul style="list-style-type: none"> ⑩ Don't know what medicine the patient should take after the shift 	<ul style="list-style-type: none"> ⑩ Smart pill box
C4	Female	70	-	<ul style="list-style-type: none"> ⑩ Afraid of the patient getting lost. ⑩ Afraid of repeated administration of a drug 	<ul style="list-style-type: none"> ⑩ Smart pill box ⑩ IoT device

Research Process

As the research method mentioned above, we conducted two semi-structured interviews, which we will continue to discuss in Depth according to the respondents' answers. Before the interviews, we first introduce and explain the research purpose to the caregivers and the care receivers, asking if they can accept their answers to be taped for later research, and promise these will only be used for academic research so that the interviewees can be psychologically prepared for the interview. Besides, instead of forcibly visiting one by one according to the questionnaire content, the interviewees can naturally continue the topic and answer the true thoughts and feelings.

In the first interview, we inquired deeply about the pain points and the needs while the care receivers are receiving the home care service. At the same time, we observe and record the interaction between the caregiver and care receiver during the interview and ask how they feel. In the second interview, we ask them the functional requirements of the technological solutions that we proposed after the first interview, as well as the degree to which difficulties are solved under the condition of applying technological solutions, so as to know their satisfaction toward the technology-enabled home care services.

RESULTS AND DISCUSSIONS

Pain Points and Technological Solutions

Based on the answers and observation during the first state of the interview, we analyzed the care receivers' feelings and needs when they are receiving the home care service and carried out three pain points. Firstly, the elderly are worried about being scolded due to not taking medicine on time. The caregiver is also worried about the disease being ignored by the elderly, so someone needs to remind or assist when it is time to take medicine. Secondly, during the non-caregiver assistance period, when the elderly encounter sudden pain or illness caused by the injury or disease, they will often feel frustrated and is worried whether if it is a complication or not. Therefore, it is necessary to monitor and record the physiological state of the body throughout the day and be able to detect emergency situations and call for assistance or rescue immediately. Lastly, to most of the interviewees, the third pain point is the difficulty in getting in and off the bed, and it is painful due to the pressure on the wound when turning over during sleep, which makes them have a poor quality of sleep. Hence, a deformable mattress is needed, which is convenient for the elderly to get in and get off the bed. It can also be used for rehabilitation during home care and detect sleep quality, posture in bed or turnover, etc.

According to the needs and pain points above, the technological solution is proposed. The solution to the first pain point is the smart pill box, which helps family members or caregivers remind the elderly to take medicine. Moreover, the solution of the second pain point is the wearable physiological monitoring device and health cloud, which monitors the health status of the care receiver around the clock, notifies family members or caregivers in case of emergency, and uses health cloud to record health data, location, historical activities, and other information. Lastly, the solution of the third pain point is the smart mattress which provides a deformation function to make it easy for patients to get in and out of bed and for rehabilitation.

Care Receivers' Attitude and Opportunities

Based on the technological solutions mentioned above, we conducted a second interview to find out the care receivers' and caregivers' attitudes toward these technological solutions. Besides, with the help of the user journey map, we try to have an in-depth understanding of the care receivers' mood and pain points when using these technologies and the opportunities to it.

(1) Opportunity 1 – A wearable device

According to the caregivers and care receivers interviewed, the functions that wearable devices should have been classified into two major features, the first one is the positioning system for monitoring the location of the care receivers and SOS emergency call function, and the second one is sleep monitoring and personal health data collection. Figure 1 below shows the care receiver's user journey map of the wearable device. We find out that due to the incomprehension of smart technology, care receivers have a lower mood for the need to purchase wearable devices, and they are more likely to feel frustrated and irritable when they have difficulties in using the product. But as soon as they realize that caregivers and themselves can monitor their health status constantly and they don't need to worry about getting lost, their mood goes up accordingly.

(2) Opportunity 2 – Smart mattress

According to the caregivers and care receivers interviewed, the functions that smart mattresses should have been classified into two major features, the first one is to help the care receivers get in and off the bed more easily, and the second one is to show the long-term compressed parts of the care receivers and remind family members to turn over and pat their backs. Figure 2 below shows the care receiver's user journey map of the smart mattress. We find out that the care receivers first think that the smart mattress is too expensive and feel that the product is unnecessary. After buying and using the product, they feel frustrated at the beginning because they don't know how to use it, and the data recorded shows that himself or herself has poor sleeping quality. However, as the lifting function and the recorded data really help and makes them live more comfortably, their mood goes up accordingly.

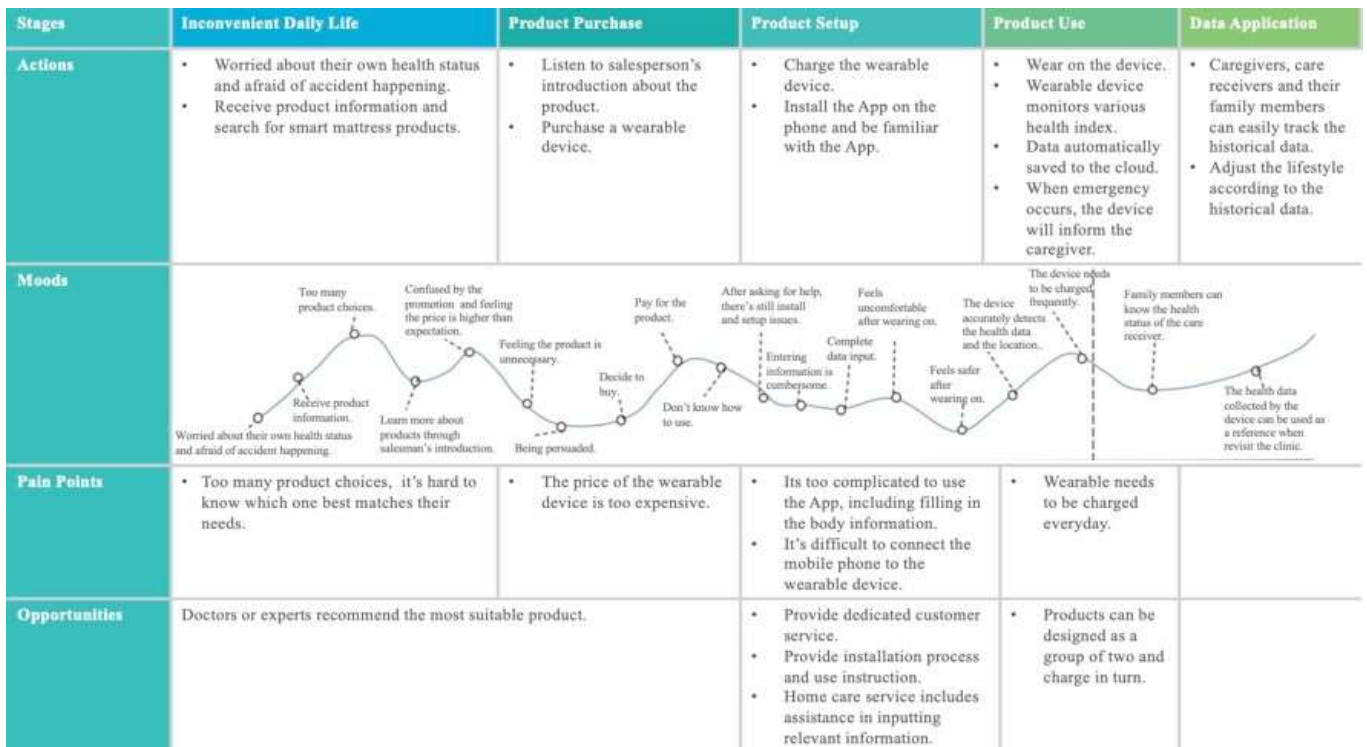


Figure 1: Wearable Device User Journey Map

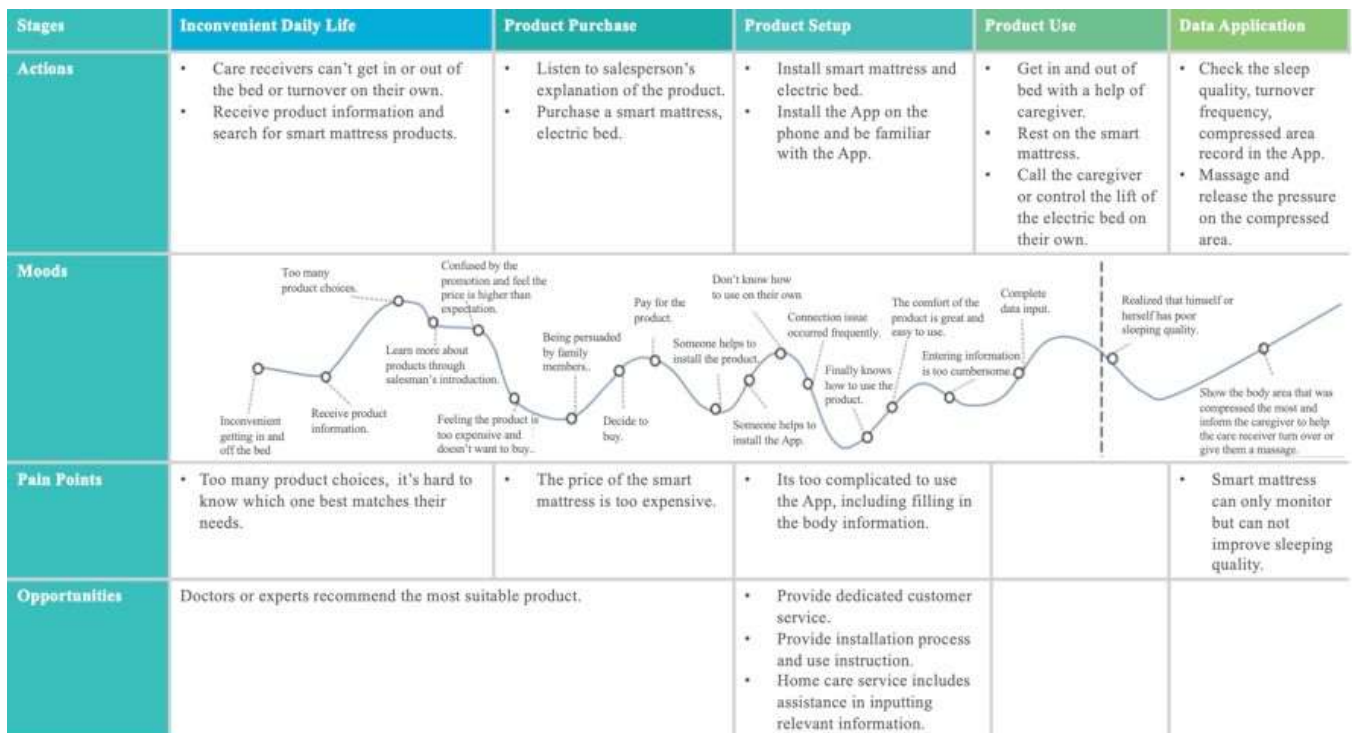


Figure 2: Smart Mattress User Journey Map

Stages	Inconvenient Daily Life	Product Purchase	Product Setup	Product Use	Data Application
Actions	<ul style="list-style-type: none"> • Patient often forget to take medicine, family members don't know how the drugs were used. • Receive product information and search for smart pill box products. 	<ul style="list-style-type: none"> • Listen to salesperson's explanation of the product. • Purchase a smart pill box that meets their requirements 	<ul style="list-style-type: none"> • Install the APP on the phone and connect it to the pillbox. • Fill in personal data and be familiar with the app. 	<ul style="list-style-type: none"> • Put the medicine into the pill box according to the dosage. • Take medicine when the pill box sends the alert. 	<ul style="list-style-type: none"> • Caregivers, care receivers and their family members can easily track the historical data.
Moods					
Pain Points	<ul style="list-style-type: none"> • Too many product choices, it's hard to know which one best matches their needs. 	<ul style="list-style-type: none"> • The price of the smart pill box is too expensive. 	<ul style="list-style-type: none"> • Its too complicated to use the APP, including filling in the body and medication information. • It's difficult to connect the mobile phone to the smart pill box. 	<ul style="list-style-type: none"> • The pill box's drawer is too small to pack a large dose. 	
Opportunities	<ul style="list-style-type: none"> • Doctors or experts recommend the most suitable product. 		<ul style="list-style-type: none"> • Provide dedicated customer service. • Provide installation process and use instruction. 		

Figure 3: Smart Pill Box User Journey Map

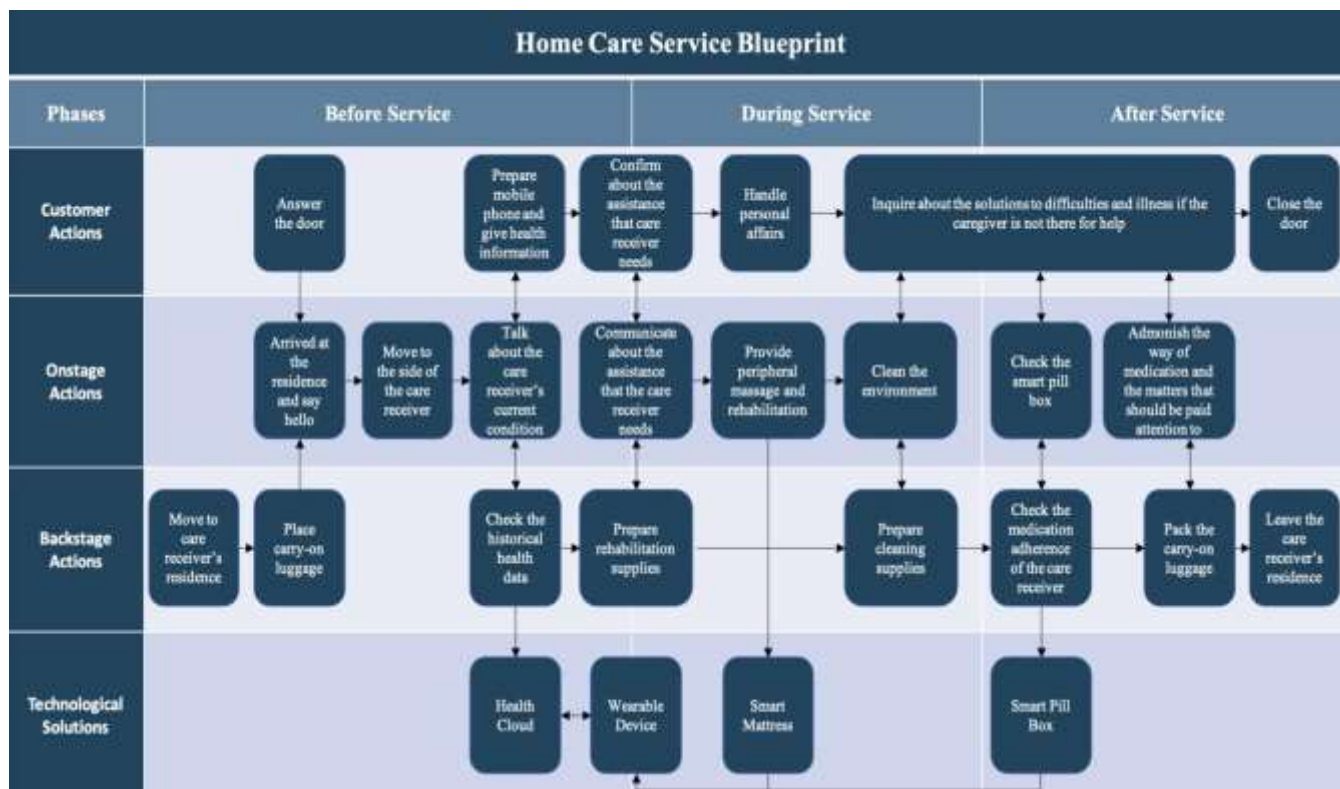


Figure 4: Technology-enabled home care service blueprint

(3) Opportunity 3 – Smart pill box

According to the caregivers and care receivers interviewed, the functions that the smart pill box should have been classified into two major features. The first one is to remind them to take medicine at the right time with the right number of pills. The second one is to notify the caregivers through the mobile application if the care receivers forgot to take medicine. Figure 3 below shows the care receiver's user journey map of the smart pill box. We find out that due to the incomprehension of smart technology, care receivers have a lower mood for the need to purchase smart pill boxes. Besides, they also feel frustrated because of the difficult and cumbersome steps of loading the medicine into the pill box. However, after confirming that the pill box will remind them to take the medicine on time and they don't need to worry about being scolded because of forgetting to take medicine, their mood rises accordingly.

Service Blueprint of the Technology-enabled Home Care Service

This research takes the health cloud as the main axis. We incorporate three technological solutions into the overall home care service process, design a new blueprint, and draw the whole service process in detail. We expected to provide a reference for home care service providers for applying smart technologies to their home care service models and create new value from managing their operations. Figure 4 shows the technology-enabled home care service blueprint.

CONCLUSION

From the overall interview and the user journey map, this research found out that there are several problems that need to be overcome when introducing smart technologies into the current home care service. Firstly, the care receivers are mostly elderly people who don't know much about technology and are not good about using smart products. They are relatively easy to feel frustrated when using these technologies. Therefore, the companionship and guidance of family members and caregivers are particularly important. Only when the care receivers clearly understand the use of the products and accept the products from the bottom of their hearts can these technological solutions fully achieve their due efficacy. Besides, we found that the care receivers and their family members often face difficulty in product selection, installation, and setting. Therefore, recommendations or suggestions from third parties, such as doctors or experts, and perfect after-sales service of the smart technology providers (including assistance in installation, recording teaching videos, and dedicated customer service) are all opportunities for future improvement. At the same time, several limitations of this study should be addressed. First, a key limitation is the sample size. Since the elderly with different ages or levels of disability might have different needs and hold a different attitude toward smart technology products, future research could replicate this study using a larger and wider sample size. Second, in this study, we discussed the care receivers' attitudes toward smart technology products separately. However, they might feel stressed and offended because of using so many of these technologies in their lives. Hence, this issue should also be discussed and measured in the future.

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